GENERAL NOTES.

Fern Distribution in the U. S.—Mr. Geo. Davenport has read before the *Am. Phil. Soc.* a paper containing some comparative tables showing the distribution of ferns in the United States. This is in anticipation of the publication of a Text Book and Manual of the Ferns of North America, for which these tables were prepared. Some notes upon them will be of interest to all. Up to the date of publication (Feb. 2, 1883), the entire fern flora of the U. S. contained 162 or 164 known species. Of the States, New York leads with 52 species, followed by California with 48, Florida and Michigan with 47 each, Arizona with a probable 47, and Vermont with 45. Mr. Davenport thinks that owing to the contiguous unexplored Mexican territory, Arizona will lead all the other States in the wealth of her fern flora. The only other States containing 40 or more species are, Pennsylvania (42), Kentucky (41), Arkansas (41), and Connecticut (40). *Pteris aquilina*, *Adiantum pedatum*, *Cystopteris fragilis*, and *Asplenium Trichomanes* are probably the most cosmopolitan, and *Polypodium vulgare* has almost as great a range. Florida is distinguished in monopolizing all the species we have in six genera; these, of course, being tropical. The only other State which has the monopoly of a genus is New Jersey with its very local *Schizæa*. Only recently the discovery of *Scolopendrium* in Tennessee divided the honor of its presence with New York.—J. M. C.

Castor Oil Wood.—Soon after the completion of the University plant houses last spring, there were planted in the large central bed of the palm-house, for want of something more desirable, a number of different kinds of *Ricinus*. These were allowed to grow for seven months, when they were cut down to make room for other plants. At this time all of the twelve kinds were above fifteen feet in height, while the largest, the seeds of which had been received under the name of *Ricinus Africanus*, was eighteen feet in height, with a trunk fully ten inches in circumference at the base. Noticing the woody character of these trunks, which, for the first two or three lower joints, were unexpectedly solid and firm, with scarcely a trace of pith, some of them were seasoned, and have since been worked up. The wood is of light color, closely resembling basswood in appearance, but without any trace of concentric rings indicating periodic growth. Under the microscope the wood-cells are found to be of large size, with very numerous dotted ducts intermixed, while the medullary system is unusually well developed. To determine the character of the wood, some comparisons with other kinds have been made. Weight of a cubic inch of completely dried wood in grams: Red oak, 8.82; butternut, 7.12; sugar-maple, 11.21; white pine, 6.22; Ricinus, 4.53. Weight in grams of water absorbed by each block when immersed for several days: Red oak, 8.77; butternut, 7.78; sugar-maple, 8.22; white pine, 6.43; Ricinus, 14.44. Percentage of ash: Red oak, 0.26; butternut, 0.51; sugar-maple, 0.46; white pine, 0.11; Ricinus, 2.20. Specific gravity: Red oak, 0.5385; butternut, 0.4347; sugar-maple, 0.6843; white pine, 0.3797; Ricinus, 0.2766. In *Forestry Bulletin*, No. 22,

two kinds of wood are mentioned which have a lower specific gravity than Ricinus, namely, *Salix discolor*, 0.2259, and *Yucca baccata*, 0.2724. It seems worthy of note that a solid trunk of wood, three inches in diameter, even of no better quality than this, was grown from the seed in seven months.—A. N. PRENTISS, *Cornell University.*

The Shapes of Leaves.—Following is a résumé of a series of papers in *Nature* on the above topic, by Prof. Grant Allen. Like his other recent contributions to evolutionary botany, they contain the result of much careful observation and clever reasoning; and while we can not give assent to all his positions, we welcome the essays because they can not fail to stimulate inquiry in this much-neglected field.

I. *General Principles.*—The leaf is the essential and really active part of the vegetable organism. Its chief function is the absorption of carbonic dioxide from the air, and its deoxidation under the influence of sunlight. Two main conditions affect the shape and size of leaves: first, the nature and amount of the supply of CO_2; and second, the nature and amount of the supply of sunshine. There is a great struggle among plants for the CO_2 of the air, and through natural selection each plant tends to have its chlorophyll disposed in the most economical way for catching such sunlight as it can secure, and its absorbent surface so disposed as to catch such particles of carbon as pass its way. Each plant inherits a general type of foliage from its ancestors, and modifies it to suit the exigencies of its altered conditions. The actual shape is not always the ideally-best shape for those conditions, but it is the best possible adaptive modification of a pre-existing hereditary type. The venation tends most generally to reproduce itself under all varieties of external configuration. This venation is a fixed generic or tribal characteristic, and with very slight structural modifications we find great differences in the resulting outline. *Ranunculus aquatilis* has two forms of leaves, those floating on the surface full and rounded, the lower ones, like all submerged leaves, becoming minutely subdivided into long, almost hair-like filaments, in this simulating the streaming *Algæ* and *Characeæ*. Both forms of leaf preserve the ranunculaceous type in their venation.

II. *Extreme and Intermediate Types.*—Where access to sunlight and CO_2 is unimpeded in all directions the leaves tend to assume a completely rounded form. This condition is most common on the surface of the water, hence most water plants with floating leaves take this shape, e. g., *Lemna*, *Nelumbium* and *Nymphæa*. Occasionally this freedom is found among land plants, e. g., *Podophyllum*, *Tropæolum majus*, and *Hydrocotyle*. The common weedy plants, especially the annuals and non-bulbous perennials, which, growing thickly together, can not afford material to push broad leaves above their neighbors' heads, and are therefore compelled to fight among themselves for every passing particle of carbon, have their leaves very minutely subdivided, e. g., the *Umbelliferæ*. The whorling of linear leaves occasionally serves the same purpose as minute segmentation. Sometimes plants with ovoid leaves in a rosette insure them-

selves a good supply of carbon by keeping under all competitors by their close ufts , e. g., *Plantago major.*

III. *Origin of Types.*—There are two ways, according to Herbert Spencer, in which a stem may be developed from stalkless creeping fronds: first, by the inrolling or folding of the fronds forming a tube with adnate edges and resulting in the endogenous stem and monocotyledonous embryo; second, by the thickening and hardening of a fixed series of midribs, resulting in an exogenous stem and dicotyledonous embryo. Monocotyledonous leaves tend to show little distinction between blade and petiole, to assume a lanceolate or linear shape and parallel venation, because the fibro-vascular bundles will tend to run continuously over every part, since the leaves are mere prolongations of the stem-forming portion, and because this venation is most convenient for long, narrow leaves. Of dicotyledonous leaves the opposites are true. The central type of leaf among monocotyls is long, narrow and rather fleshy; among dicotyls, simple, ovate and nearly ribless, or with faint digitate venation. Pinnate venation replaced palmate whenever circumstances caused leaves to lengthen faster than they broadened, the main ribs then being given off, not from the same point, but a little in front of one another. Pinnate ribs seem especially adapted to forest trees, probably protecting them against storms. The shapes of leaves thus depend upon two factors: first, the ancestrally inherited peculiarities of type and venation; second, the actual conditions to which the species is habitually exposed.

IV. *Special Types.*—Sessile leaves are particularly apt to be lanceolate. Decurrent leaves show the traces of the primitive unity of stem and leaf. Radical leaves, with long foot-stalks, will commonly be orbicular cordate and are most frequently produced from perennials with richly-stored root-stocks. The shapes of the leaves of climbers and trees have reference only to exposure to sunlight. Unequal exposure causes them to become oblique, e. g., *Begonia* and *Tilia.* Growth in dry soil and proximity to the sea, whether the plant grow in sand or mud, both tend to produce succulence. C. R. B.

EDITORIAL NOTES.

THE REPORT OF THE BOTANICAL SECTION of the Acad. Nat. Sci., Philad., for 1882, makes a good showing for the Herbarium, no less than 3,346 species having been added, one-third of which were new to the collection, and 100 of the genera not before represented. This is the largest annual addition since the organization of the Section, and is chiefly due to the zeal and liberality of Messrs. Redfield, Canby, Parker, Martindale, Meehan and others. Dr. Gray supplied more than 1,000 species, and Prof. Sargent furnished choice herbarium specimens of some of our rarer trees and shrubs. All this has thrown much labor on the Conservator, Mr. John H. Redfield, who has been ably assisted by the Philadelphia botanists above mentioned.